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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/735,494	12/12/2003	Paul Douglas Yoder	51527/SAH/T539	1869

7590 05/15/2006

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EXAMINER
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DICKEY, THOMAS L

ART UNIT	PAPER NUMBER
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2826

DATE MAILED: 05/15/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/735,494

Applicant(s)

YODER, PAUL DOUGLAS

Examiner

Thomas L. Dickey

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 24 March 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 15-20,22-28,30,31 and 33-35 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 15-18,28,31 and 33-35 is/are allowed.
- 6) ☒ Claim(s) 19,20,24,27 and 30 is/are rejected.
- 7) ☒ Claim(s) 22,23,25 and 26 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

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## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 03/24/2006 has been entered.

### ***Information Disclosure Statement***

2. If applicant is aware of any relevant prior art, he/she requested to cite it on form **PTO-1449** in accordance with the guidelines set forth in M.P.E.P. 609.

### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

Claim 30 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

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Claim 30 purports to depend from claim 29, a cancelled claim. Hence the scope of claim 30 cannot be determined.

Correction is required.

***Claim Rejections - 35 USC § 103***

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 19,20,24, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over YAO (2003/0111675) in view of AUGUSTO (2005/0167709).

Yao discloses an avalanche photodetector comprising an InGaAs absorption layer 22 having a top and a bottom, a multiplication region 62 disposed facing said bottom and including at least one multiplication layer and a charge layer 72 including dopant impurities therein interposed between said absorption layer 22 and said multiplication region 62; said absorption layer 22 including a P-type impurity therein, wherein said P-type dopant impurity comprises zinc (note paragraph 0025), and a graded transition region 52 disposed between said absorption layer 22 and said multiplication region 62, said graded transition region 52 being a graded-bandgap material, including a graded conduction band energy level that produces a gradual change between a first conduction band energy level of said absorption layer 22 and a second conduction band

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energy level of said multiplication region 62. Note figure 2 and paragraphs 0022-0025 of Yao. Yao does not disclose that the P-type impurity has a concentration gradient such that said P-type impurity concentration decreases from said top to said bottom.

However, Augusto discloses an avalanche photodiode where an absorption layer has a P-type impurity concentration decreases from said top to said bottom. Note paragraphs 0191-0196 of Augusto. Note particularly paragraph 0196, where Augusto explains the importance of producing a drift field in the absorption region by making a slope in the conduction band edge by, for example, grading the doping profile in the absorption region. Note that Augusto is a 371 of PCT/EP03/10346, an international application filed under the treaty defined in 35 USC § 351(a) and published in English, which itself claims priority to U.S. provisional application 60/412139, filed 09/19/2002.

Therefore, it would have been obvious to a person having skill in the art to modify the absorption layer of Yao's avalanche photodiode to give the P-type impurity has a concentration gradient such that said P-type impurity concentration is graded from top to said bottom such as taught by Augusto in order to transport photo-generated carriers out of the absorption region to thus provide a higher photo-generated current.

***Allowable Subject Matter***

5. Claims 22,23,25, and 26 are objected to as being dependent upon a rejected base claims, but would be allowable if rewritten in independent form including all of the limitations of their respective base claims and any intervening claims.

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6. Claims 15-18 are allowed over the references of record because none of these references disclosed or can be combined to yield the claimed invention such as an APD having, in addition to a multiplication region and a first multiplication layer (i.e. two multiplication parts), a charge layer is interposed between said multiplication region and a absorption layer having a P-type dopant impurity with an "x" gradient such that  $\partial \ln N / \partial x \geq 3 \text{ K eV / cm}$  (0.3 eV/micron) divided by  $kT$ , where  $k$  is the Boltzmann constant,  $T$  represents operating temperature of said photodetector in degrees Kelvin,  $q$  is the fundamental unit of charge,  $N$  represents concentration of said P-type dopant impurity, and  $x$  represents distance from one of the top and bottom of the absorption layer, as recited in claim 15.

7. Claims 28,31, and 33-35 are allowed over the references of record because none of these references disclosed or can be combined to yield the claimed invention such as an avalanche photodetector comprising an absorption layer, a multiplication region and a charge layer disposed between said multiplication region and said absorption layer, said multiplication region consisting of only two multiplication layers including a first multiplication layer formed of a relatively wide bandgap material and disposed closer to said absorption layer and a second multiplication layer formed of a relatively narrow bandgap material and disposed further from said absorption layer, said first multiplication layer and said second multiplication layer having a combined thickness of at least 0.2 microns and a charge layer thickness is no greater than 10% of said

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combined thickness, and wherein said first multiplication layer is formed of substantially the same material as said charge layer, as recited in claim 28.

Note that Ko et al. 2004/0251483, previously cited in this case, discloses all the limitations of claim 28 except first and second multiplication layers having a combined thickness of at least 0.2 microns and a charge layer thickness no greater than 10% of said combined thickness.

### ***Response to Arguments***

8. Applicant's arguments with respect to claims 19, 20, 24, 27, and 30 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

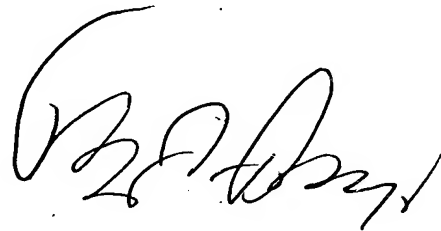
9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thomas L. Dickey whose telephone number is 571-272-1913. The examiner can normally be reached on Monday-Thursday 8-6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan J. Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status

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information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'T. L. Dickey', is positioned above the printed name.

**Thomas L. Dickey**  
**Patent Examiner**  
**Art Unit 2826**  
**04/06**